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(54) **PLUG CONNECTOR FOR DIFFERENTIAL TRANSMISSION**

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(52) **U.S. Cl.** **439/108**; 439/608
(58) **Field of Search** 439/108, 101, 439/608, 607, 609, 610

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(74) *Attorney, Agent, or Firm*—Staas & Halsey LLP

(57) **ABSTRACT**

A plug connector for differential transmission is disclosed. The plug connector includes ground contact members and signal contact pairs that are arranged alternately. Each signal contact pair is composed of first and second signal contact members. The mounting terminal part and a portion of the base part on the mounting terminal part side of each ground contact member are thinner than the ground contact part of the ground contact member. The mounting terminal parts of the first and second signal contact members and the mounting terminal parts of the ground contact members are positioned in the same plane so that the mounting terminal parts of the first and second signal contact members of each signal contact pair are disposed between the mounting terminal parts of the ground contact members adjacent to the signal contact pair.

7 Claims, 7 Drawing Sheets

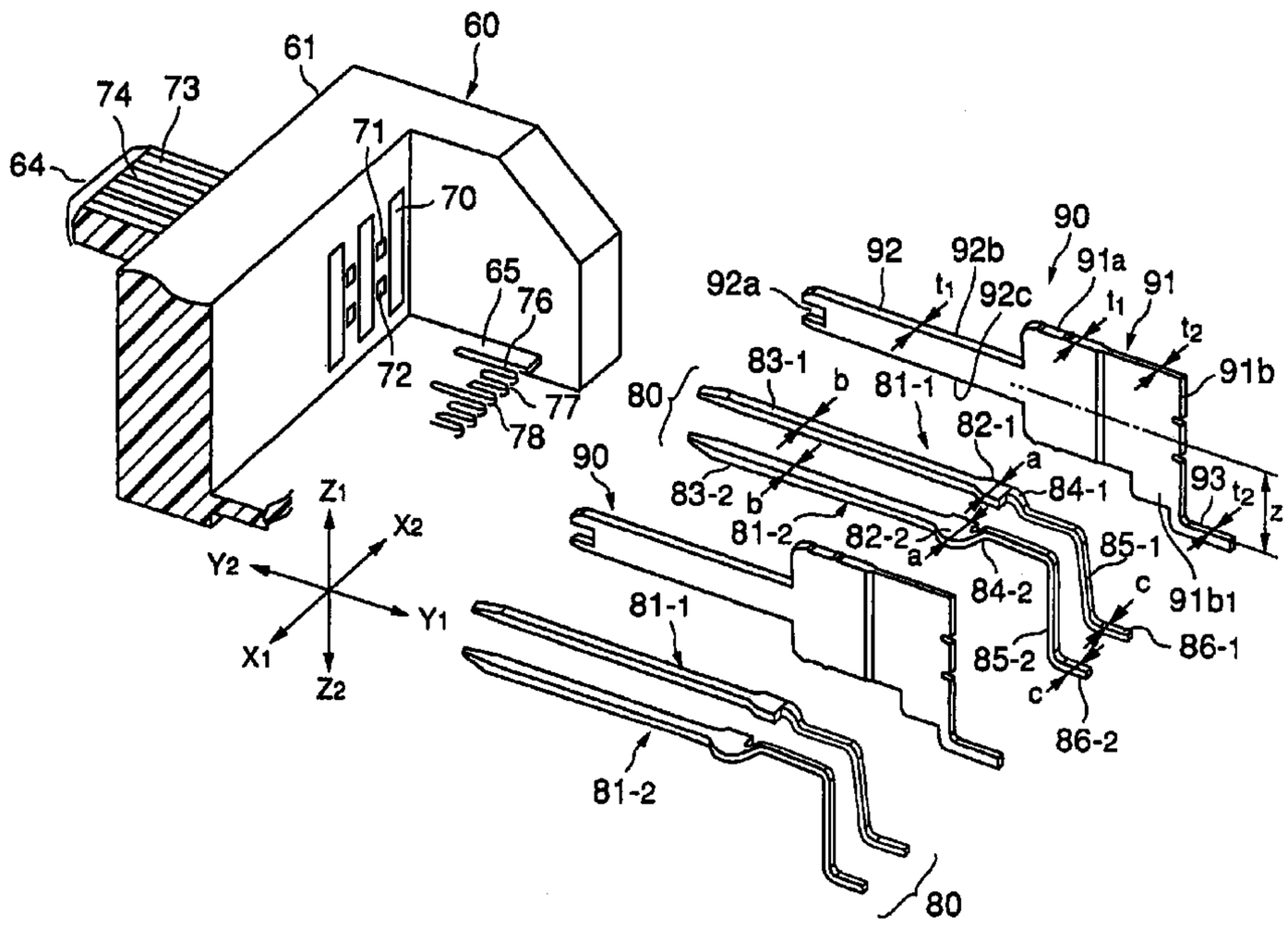


FIG.1 PRIOR ART

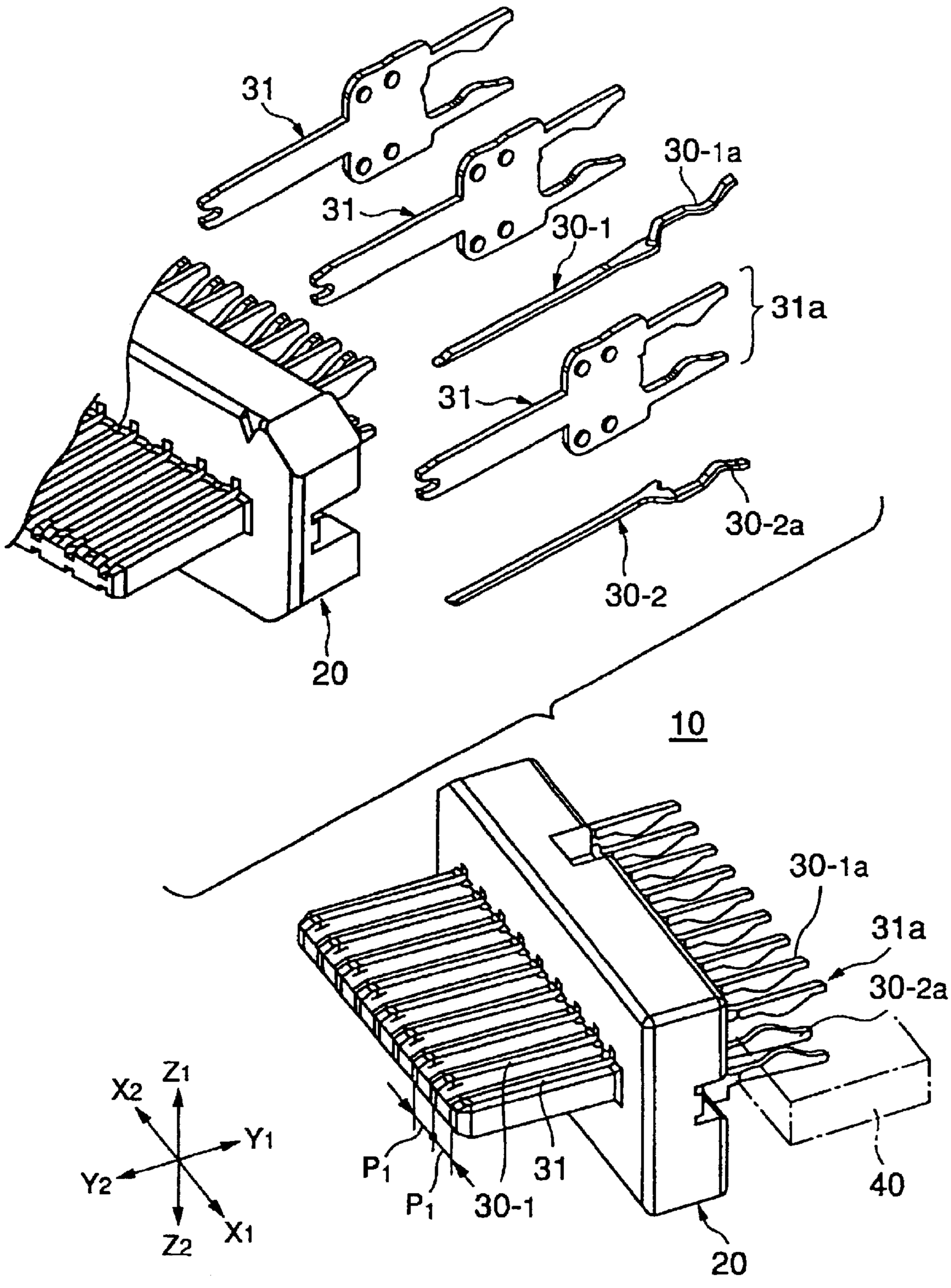


FIG.2

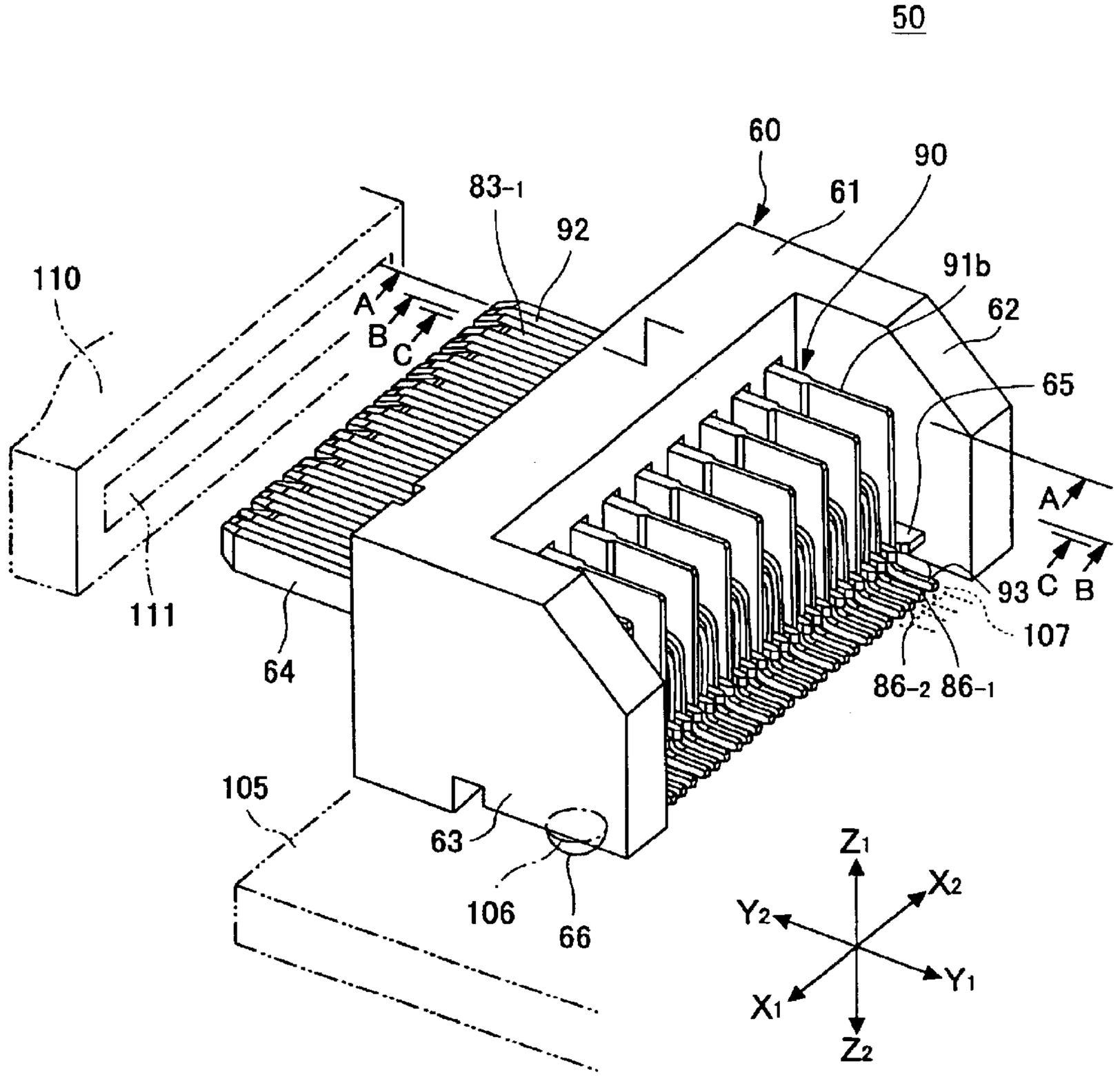
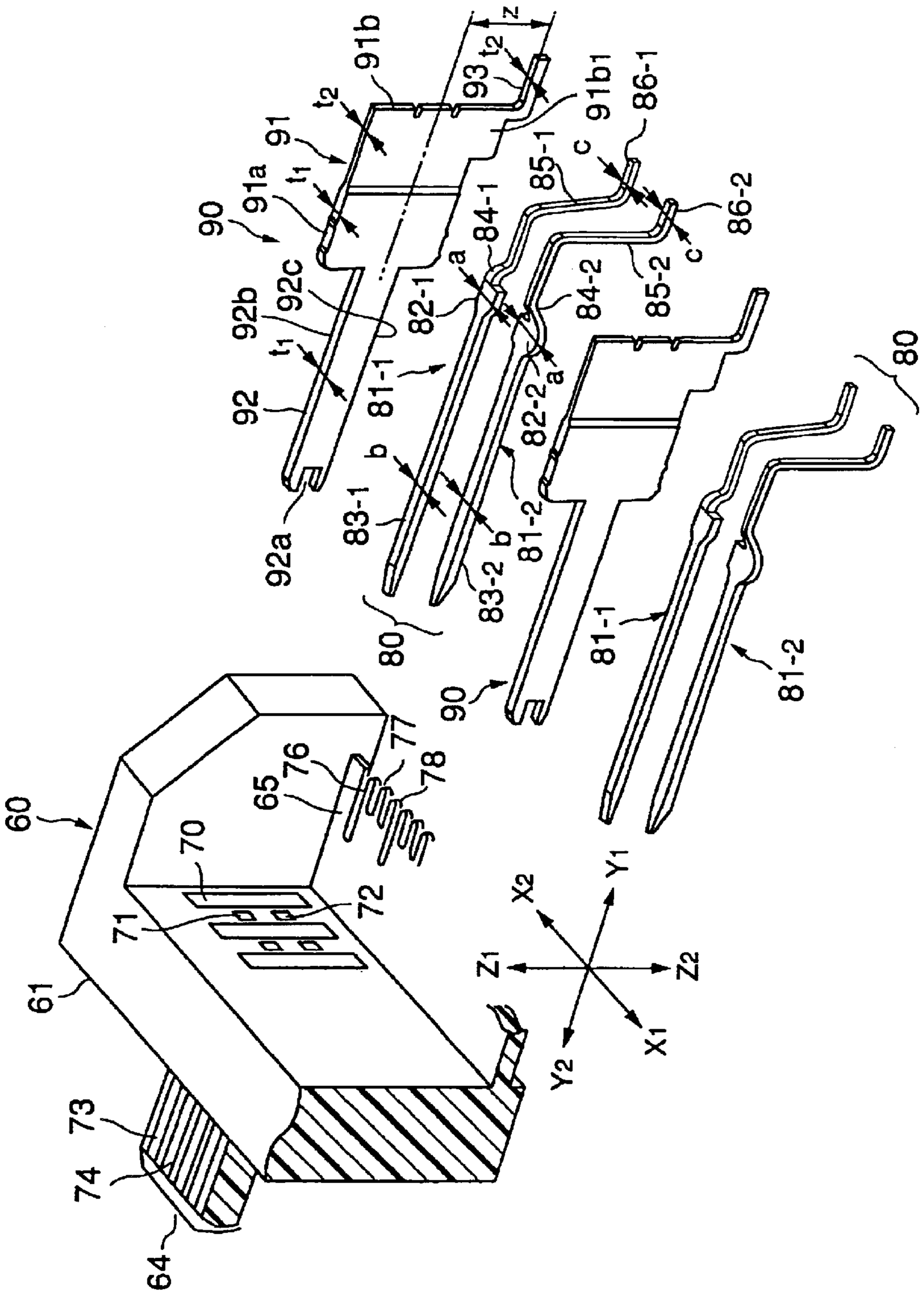

50
60
90
61
83-1
92
91b
62
65
110
A
B
C
111
64
93
107
86-2
86-1
105
63
106
66
Z1
X2
Y2
Y1
X1
Z2

FIG.3


91b
z
t2
93
91b1
86-1
91
t2
c
85-1
91a
t1
90
84-1
86-2
a
82-1
92b
92c
84-2
85-2
c
t1
81-1
92
b
83-1
82-2
a
92a
81-2
83-2
b
80
90
81-1
80
81-2
60
70
65
76
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72
71
61
73
74
64
X2
Y1
Z1
Z2
Y2
X1

FIG.4

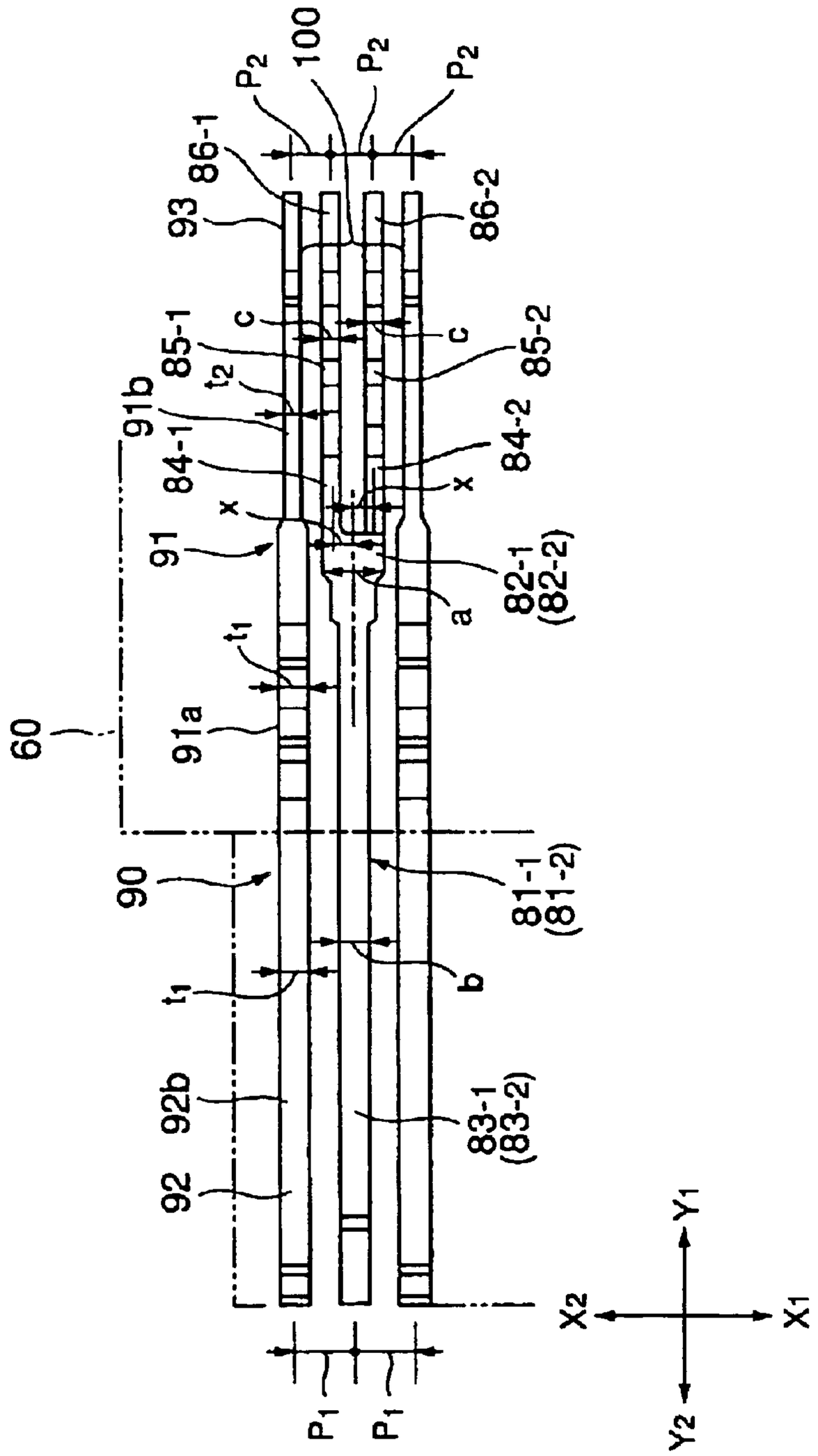

P2
100
P2
P2
86-1
93
86-2
91
85-1
c
c
85-2
91b
t2
84-1
84-2
x
x
91
82-1
(82-2)
a
t1
91a
60
90
81-1
(81-2)
t1
b
92b
92
83-1
(83-2)
P1
P1
Y1
X2
X1
Y2

FIG.5A

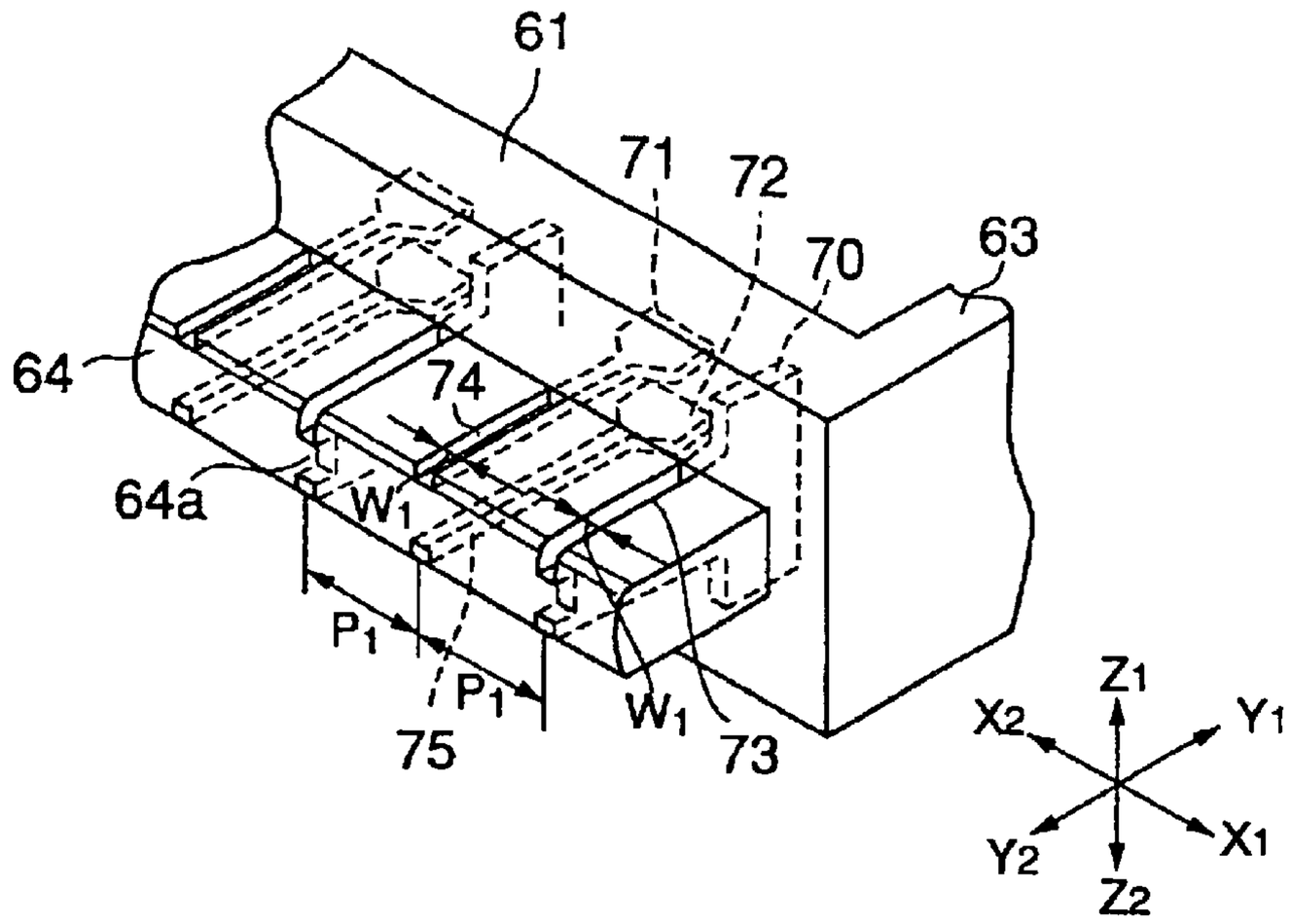
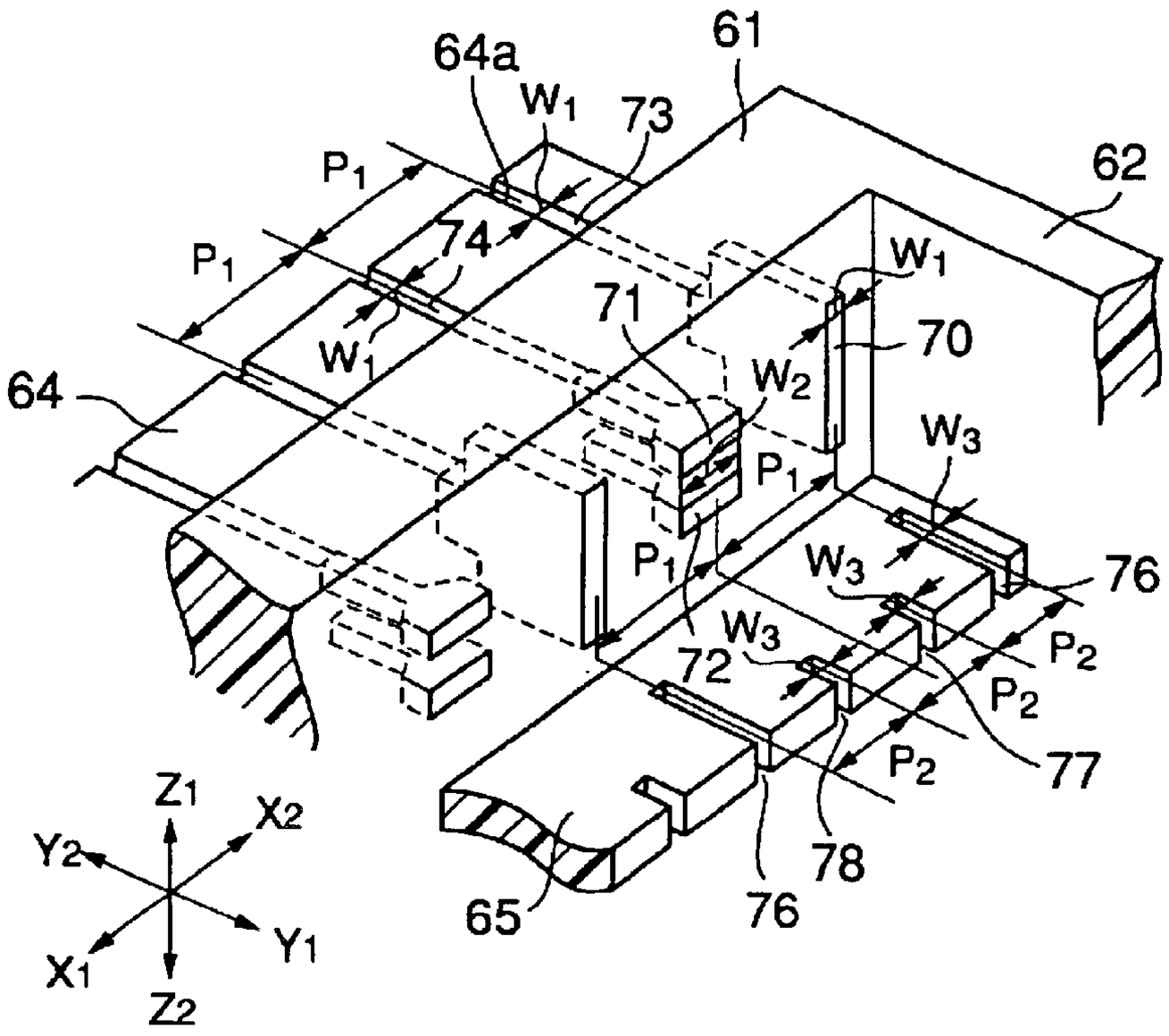

61
71
72
70
63
64
74
64a
W1
P1
P1
75
W1
73
Z1
X2
Y1
Y2
X1
Z2

FIG.5B


64a
W1
73
61
62
P1
74
P1
W1
71
W1
70
64
W2
W3
P1
P1
W3
76
W3
P2
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P2
Z1
X2
Y2
Y1
X1
Z2
65
76
78

FIG.6A

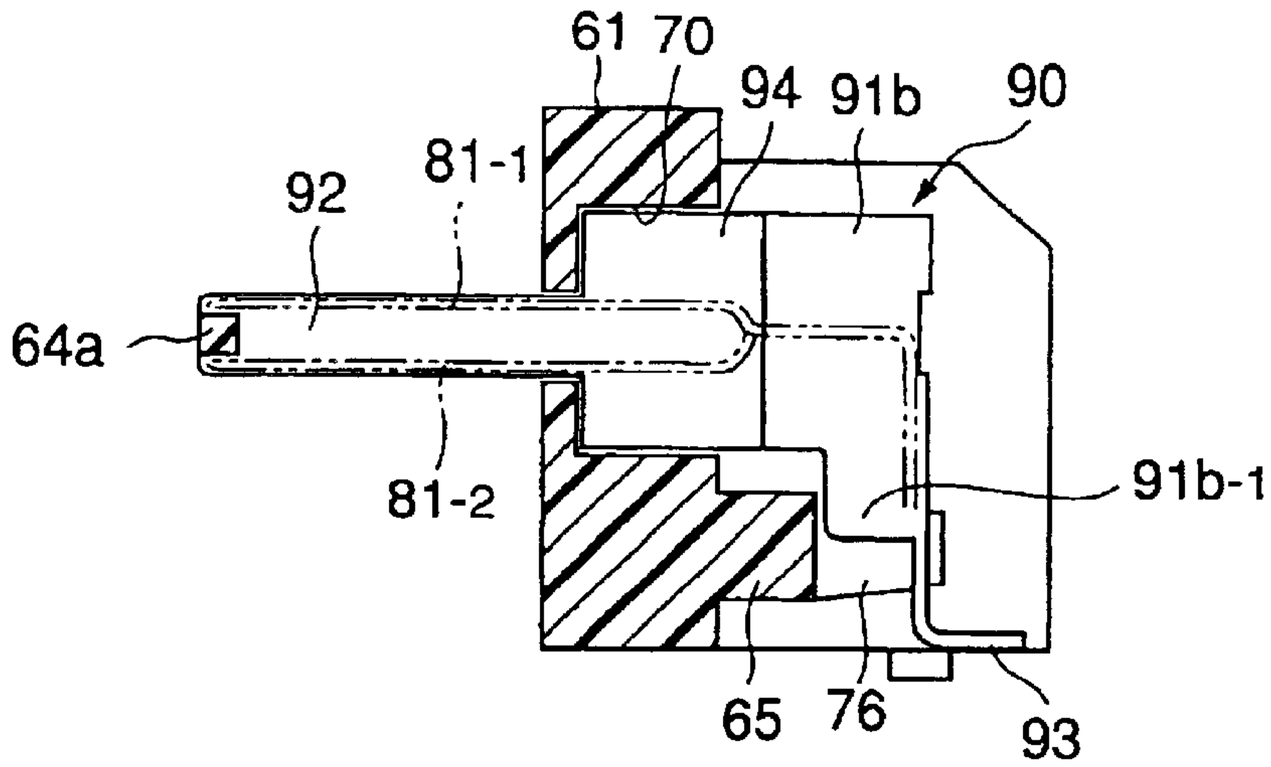


FIG.6B

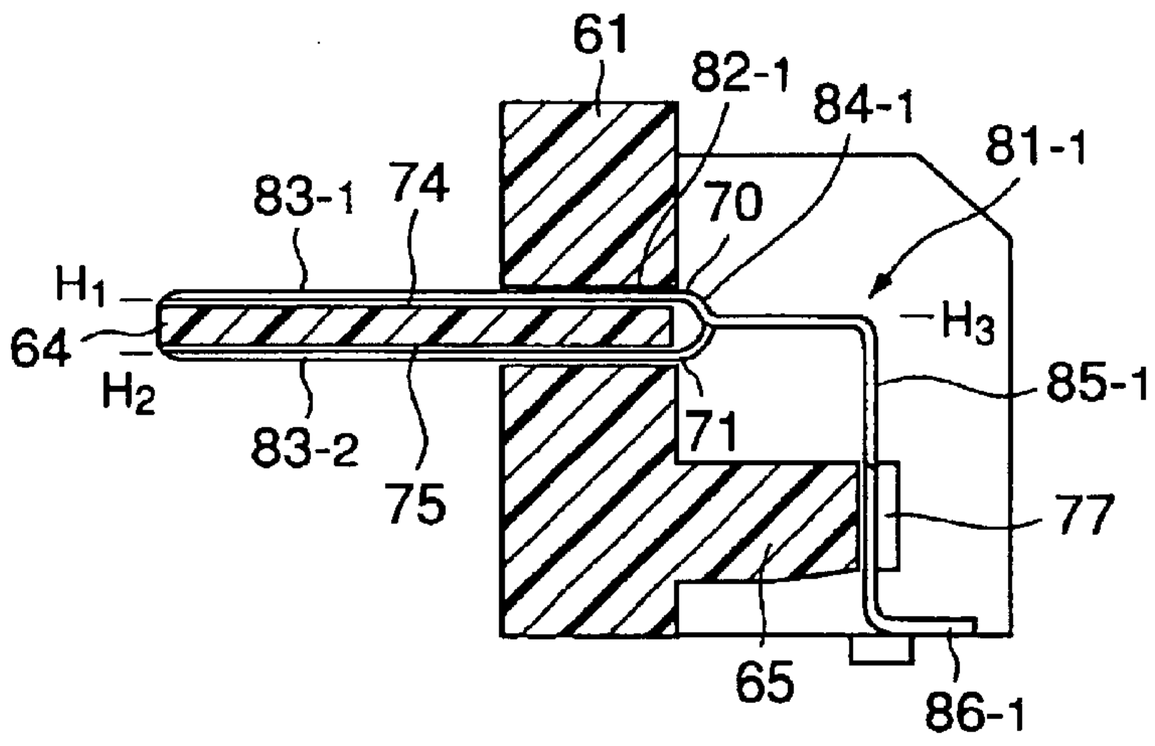


FIG.6C

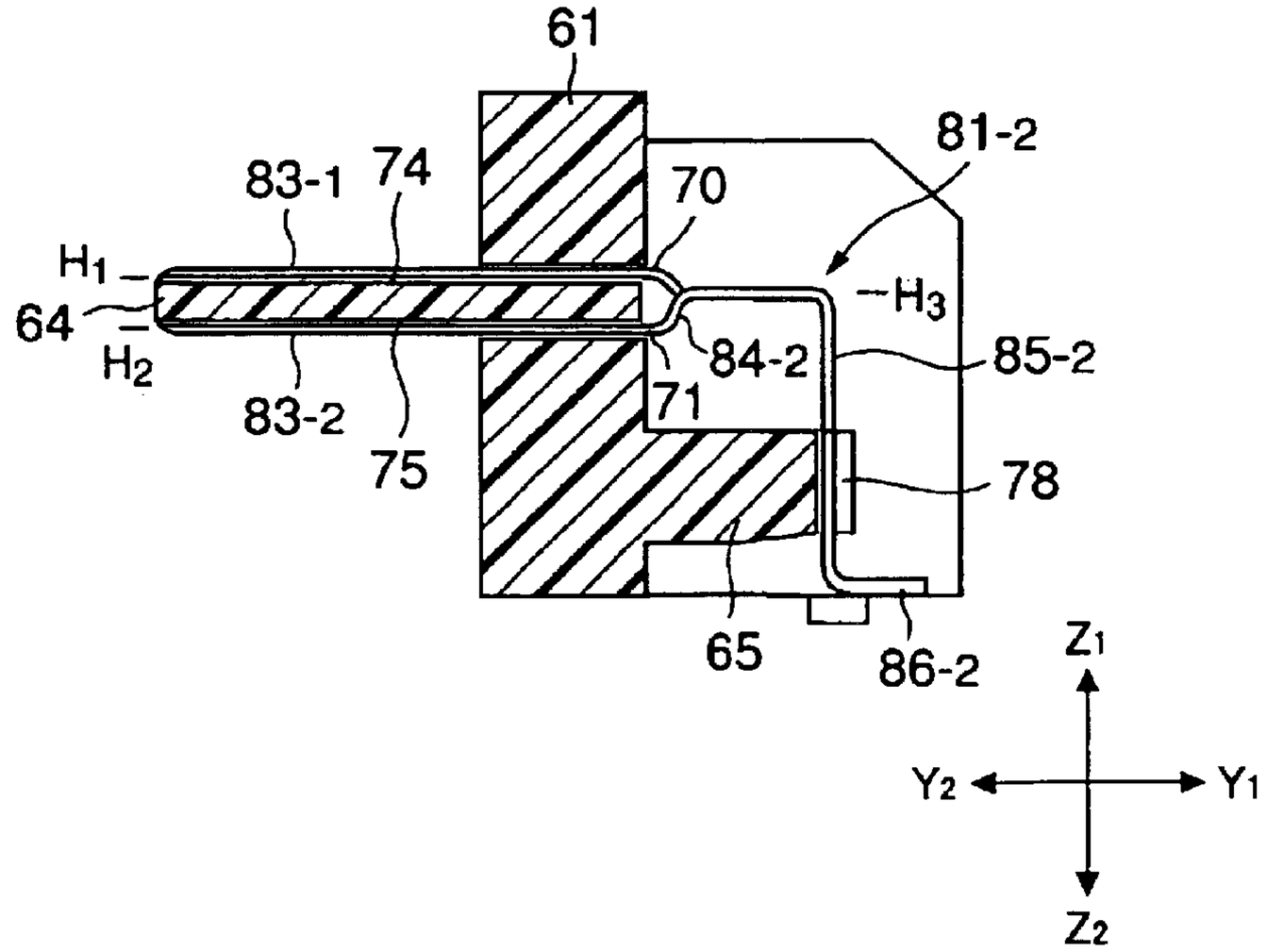
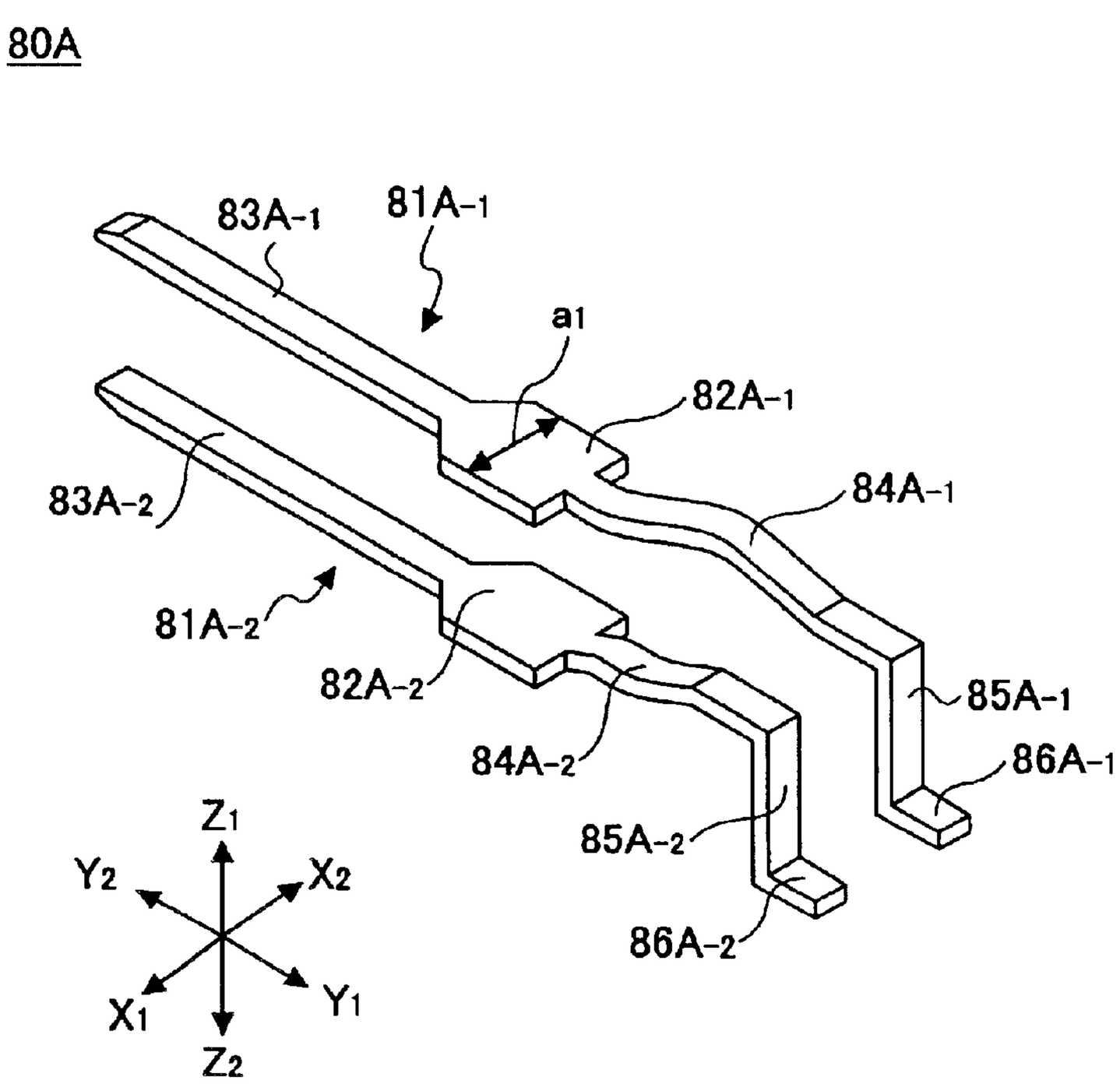


FIG.7


80A
83A-1
81A-1
a1
82A-1
84A-1
83A-2
81A-2
82A-2
84A-2
85A-1
86A-1
85A-2
86A-2
Z1
Y2
X2
X1
Y1
Z2

PLUG CONNECTOR FOR DIFFERENTIAL TRANSMISSION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to plug connectors for differential transmission, and more particularly to a right angle-type plug connector for differential transmission having L-shaped mounting terminals so as to be mounted on a printed circuit board with the connection part of the plug connector being parallel to the printed circuit board.

2. Description of the Related Art

Differential transmission has been employed in many cases as a method of transmitting data between personal computers and peripheral devices. Differential transmission uses a pair of lines for each data element, and simultaneously transmits a "+" signal to be transmitted and a "−" signal equal in magnitude and opposite in direction to the "+" signal so that the difference in level between the "+" and "−" signals is recognized as information. Differential transmission has the advantage of being less susceptible to noise compared with a normal transmission method.

In order for differential transmission to work properly, the paired lines, one for transmitting the "+" signal and the other for the "−" signal, should be parallel and equal in length. Further, ground potential should be provided between pairs of adjacent lines so that a shield is provided therebetween.

FIG. **1** is a diagram showing a conventional plug connector **10** for differential transmission. In FIG. **1**, X_1–X_2 and Z_1–Z_2 indicate the directions of width and the directions of height, respectively, of the plug connector **10**. Further, Y_2 indicates the direction in which the plug connector **10** is inserted to be connected (the insertion and connection direction of the plug connector **10**) and Y_1 indicates the opposite direction. The plug connector **10** includes a block body **20**, which is an electrically insulating molded component of a synthetic resin. Pairs of first and second signal contact members **30-1** and **30-2** and plate-like ground contact members **31** are incorporated into the block body **20** so as to be arranged alternately at predetermined pitches P_1 in the X_1–X_2 directions or along the X-axis.

Each ground contact member **31** includes a mounting terminal part **31***a* shaped like a fork. A mounting terminal part **30-1***a* of the signal contact member **30-1** and a mounting terminal part **30-2***a* of the signal contact member **30-2** extend linearly in the Y_1 direction and oppose each other in the Z_1–Z_2 directions or along the Z-axis.

The mounting terminal parts **31***a* and the mounting terminal parts **30-1***a* and **30-2***a* are soldered to pads on a printed board **40** while holding an edge part of the printed board **40** so that the plug connector **10** is mounted thereon.

Japanese Laid-Open Patent Application No. 2003-059593 discloses such a plug connector.

In recent years, differential transmission plug connectors have been used in a wide variety of modes. For instance, it has been required to mount a differential transmission plug connector on a printed circuit board with the insertion and connection direction of the plug connector being parallel to the surface of the printed circuit board. To this end, the plug connector should be of a right angle type with the mounting terminal parts of paired signal contact members being L-shaped, as parallel to each other as possible, and equal in length.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to provide a plug connector for differential transmission in which the above-described problems are solved.

A more specific object of the present invention is to provide a differential transmission plug connector of a right angle type mountable on a printed circuit board.

The above objects of the present invention are achieved by a plug connector for differential transmission, including: a block body made of an insulating material, the block body including a main body part and a projection part projecting therefrom; a plurality of plate-like ground contact members each including a plate-like base part, a ground contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the ground contact part being fixed to the main body part and the projection part, respectively, of the block body; a plurality of first signal contact members each including a base part, a signal contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the signal contact part being fixed to the main body part and the projection part, respectively, of the block body; and a plurality of second signal contact members each including a base part, a signal contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the signal contact part being fixed to the main body part and the projection part, respectively, of the block body, wherein: the first signal contact members and the corresponding second signal contact members form signal contact pairs; the signal contact pairs and the ground contact members are arranged alternately, being supported by the block body; each ground contact member is shaped so that the ground contact member thereof is positioned vertically at a distance from a plane in which the mounting terminal part thereof is disposed, and a portion of the base part thereof on a mounting terminal part side and the mounting terminal part thereof each have a dimension smaller than that of the ground contact part thereof in a direction in which the ground contact members are arranged; each of the first and second signal contact members is shaped so that a length adjustment part and an extension part are provided between the base part and the mounting terminal part thereof; and the mounting terminal parts of the first and second signal contact members and the mounting terminal parts of the ground contact members are positioned in the same plane so that the mounting terminal parts of the first and second signal contact members of each signal contact pair are disposed between the mounting terminal parts of the ground contact members adjacent to the signal contact pair.

According to the above-described plug connector, in each ground contact member, a mounting terminal part-side portion of its base part and its mounting terminal part are thinner than its ground contact part. Accordingly, the space between the mounting terminal parts of the ground contact members is increased without reducing the width of each of the upper and lower ends of the ground contact part of each ground contact member and decreasing mechanical strength. As a result, the mounting terminal parts of the first and second signal contact members can be disposed in the space between the mounting terminal parts of the ground contact members adjacent to the paired first and second signal contact members. The mounting terminal parts of the first and second signal contact members and the ground contact members are arranged in the same plane. Accordingly, a differential transmission plug connector of a right angle type that can be mounted on a printed circuit board is realized.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become more apparent from the following

detailed description when read in conjunction with the accompanying drawings, in which:

FIG. **1** is a diagram showing a conventional plug connector for differential transmission;

FIG. **2** is a perspective view of a differential transmission plug connector of a right angle type according to an embodiment of the present invention;

FIG. **3** is an exploded perspective view of the plug connector according to the embodiment of the present invention;

FIG. **4** is a diagram showing an arrangement of signal and ground contact members of the plug connector according to the embodiment of the present invention;

FIGS. **5**A and **5**B are enlarged fragmentary perspective views of a block body of the plug connector according to the embodiment of the present invention;

FIGS. **6**A through **6**C are cross-sectional views of the plug connector of FIG. **2** taken along the lines A—A, B—B, and C—C, respectively, according to the embodiment of the present invention; and

FIG. **7** is a diagram showing a variation of a signal contact pair according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description is given below, with reference to the accompanying drawings, of an embodiment of the present invention.

FIGS. **2** and **3** are diagrams showing a differential transmission plug connector **50** of a right-angle and surface-mounting type. In FIGS. **2** and **3**, X_1–X_2 and Z_1–Z_2 indicate the directions of width and the directions of height, respectively, of the plug connector **50**. Further, Y_2 indicates the direction in which the plug connector **50** is inserted to be connected (the insertion and connection direction of the plug connector **50**), and Y_1 indicates the opposite direction. The plug connector **50** includes a block body **60**, which is an electrically insulating molded component of a synthetic resin. Signal contact pairs **80** of first and second signal contact members **81-1** and **81-2** and plate-like ground contact members **90** are incorporated into the block body **60**. Referring to FIG. **4**, the first and second signal contact members **81-1** and **81-2** (signal contact pairs **80**) and the ground contact members **90** are arranged alternately at the same pitch P_1 in the X_1–X_2 directions or along the X-axis. Each of the first and second signal contact members **81-1** and **81-2** is positioned, for its length, between the adjacent ground contact members **90**.

Referring to FIGS. **2** and **3**, the block body **60** includes a main body part **61**, support parts **62** and **63** extending in the Y_1 direction from the X_2 and X_1 ends, respectively, of the main body part **61**, a plate-like projection part **64** projecting in the Y_2 direction from the main body part **61**, a position control part **65** projecting from the main body part **61** to take up the space between the support parts **62** and **63**, and boss parts **66** provided on the lower sides of the support parts **62** and **63**. The main body part **61** and the support parts **62** and **63** form a U shape when viewed from the Z_1 side. Each of FIGS. **5**A and **5**B is an enlarged view of part of the block body **60** along the X-axis. Referring to FIGS. **5**A and **5**B, slits **70** for the ground contact members **90** and tunnels **71** and **72** for the first and second signal contact members **81-1** and **81-2**, respectively, are formed alternately to be arranged at the same pitch P_1 in the main body part **61**. Slits **73**, which are the extensions of the slits **70**, grooves **74**, which are the extensions of the tunnels **71**, and grooves **75**, which are the extensions of the tunnels **72** are formed in the projection part **64**. The grooves **74** and **75** are formed on the Z_1- and Z_2-side faces, respectively, of the projection part **64**. Each slit **73** extends up to a position immediately before the Y_2 end of the projection part **64**. Parts of the projection part **64** separated by the slits **73** are connected by connection parts **64***a*. Referring to FIG. **3** and **5**B, slits **76**, **77**, and **78** are formed in the Y_1 edge of the position control part **65**. The deep slits **76** are formed at positions corresponding to the slits **70**. The shallow slits **77** and **78** are formed at such positions as to equally divide the distance between each two adjacent slits **76**. The slits **76**, **77**, and **78** are arranged at the same pitch P_2, which is two-thirds of the pitch P_1.

In the following description, width, thickness, and dimensions a, b, and c are measured along the X-axis.

Referring to FIGS. **5**A and **5**B, the slits **70**, the slits **73**, the grooves **74**, and the grooves **75** are W_1 in width. The Y_1-side entrance (opening) of each of the tunnels **71** and **72** is W_2 in width. The slits **76**, **77**, and **78** are W_3 in width. The widths W_1, W_2, and W_3 satisfy $W_3<W_1<W_2$.

Referring to FIGS. **3** and **4**, each ground contact member **90**, which is stamped out from a plate material by a press, includes a plate-like base part **91** having a bulge portion, a rectangular plate-like ground contact part **92** projecting in the Y_2 direction from the base part **91**, and a mounting terminal part **93** extending in an L-letter shape in the Y_1 direction from the Y_1–Z_2 end (corner) of the base part **91**. The mounting terminal part **93** is biased in the Z_2 direction by a dimension z relative to the Y_2–Y_1 center line of the ground contact part **92**. A Y_2-side half portion **91***a* of the base part **91** and the ground contact part **92** are t_1 in thickness. A Y_1-side half portion **91***b* of the base part **91** and the mounting terminal part **93** are struck to be thinned by a press so as to be t_2 in thickness. Thus, the thinning of the Y_1-side half portion **91***b* of the base part **91** and the mounting terminal part **93** is performed easily by press working. The thickness t_1 is equal to the width W_1 ($t_1=W_1$), and the thickness t_2 is equal to the width W_3 ($t_2=W_3$). The Y_1-side half portion **91***b* includes a Z_2-side projection portion **91***b***1** projecting in the Z_2 direction. The mounting terminal part **93** extends from the Z_2-side projection portion **91***b***1**.

Here, the thickness t_1 is set to, for instance, 0.4 mm, considering that each of the upper (Z_1-side) and lower (Z_2-side) ends of the contact part **92** of each ground contact member **90** should have a sufficient width (X_1–X_2 dimension) and that each ground contact member **90** should have such mechanical strength as to be normally press-fitted into the block body **60** without having buckling. Further, the thickness t_2 of each of the Y_1-side half portions **91***b* and the mounting terminal part **93** of each ground contact member **90** is set to, for instance, 0.2 mm, satisfying $t_2<t_1$. As a result, a space **100** (FIG. **4**) between the mounting terminal parts **93** of the adjacent ground contact members **90** along the X-axis is widened (increased) by 0.4 mm, compared with the case where the above-described thinning of the Y_1-side half portion **91***b* and the mounting terminal part **93** is not performed. Consequently, mounting terminal parts **86-1** and **86-2** of the two signal contact members **81-1** and **81-2**, respectively, can be placed side by side in the space **100**. That is, the mounting terminal parts **86-1** and **86-2** of the two signal contact members **81-1** and **81-2** can be placed side by side between the mounting terminal parts **93** of the adjacent ground contact members **90** while the pitch P_1 between the ground contact part **92** of each ground contact member **90** and the signal contact parts **83-1** and **83-2** of the signal

contact members **81-1** and **81-2** is being maintained. The Y_1-side half portion **91***b* of each base part **91** is thinned equally from both sides of the base part **91**.

Referring to FIGS. **3** and **4**, each first signal contact member **81-1** includes a base part **82-1** having a bulge portion, a rod-like signal contact part **83-1** projecting in the Y_2 direction from the base part **82-1**, a length adjustment part **84-1** (FIG. **6**B) extending in a direction between the Y_1 and Z_2 directions, that is, extending obliquely downward, from the base part **82-1**, an extension part **85-1** extending in a substantially inversed L-shape from the end of the length adjustment part **84-1**, and the mounting terminal part **86-1** extending in the Y_1 direction from the end of the extension part **85-1**. The base part **82-1** has the dimension a, the signal contact part **83-1** has the dimension b, and each of the mounting terminal part **86-1**, the extension part **85-1**, and the length adjustment part **84-1** has the dimension c. The dimensions a, b, and c satisfy c<b<a. The dimension bis equal to the thickness t_1 and the width W_1. The dimension c is equal to the thickness t_2 and the width W_3. The dimension a is approximately twice the dimension b. Referring to FIG. **4**, the center line of the signal contact part **83-1** coincides with the center line of the base part **82-1** in the Y_1–Y_2 directions or along the Y-axis. The length adjustment part **84-1** extends from the X_2 end portion of the base part **82-1**. The center line of the length adjustment part **84-1** is offset in the X_2 direction by a dimension xrelative to the center line of the base part **82-1**. The center line of each of the extension part **85-1** and the mounting terminal part **86-1** following the length adjustment part **84-1** is also offset in the X_2 direction by the dimension xrelative to the center line of the base part **82-1**.

The second signal contact member **81-2** includes a base part **82-2**, a signal contact part **83-2**, a length adjustment part **84-2** (FIG. **6**C), an extension part **85-2**, and the mounting terminal part **86-2**. The second signal contact member **81-2** is equal in shape to the first signal contact member **81-1** except that the length adjustment part **84-2** extends obliquely upward from the X_1 end portion of the base part **82-2**. The dimension xand the pitch P_2 satisfy $2\times x=P_2$. There is no need to bend the length adjustment parts **84-1** and **84-2** in the X_1 or X_2 direction so that the length adjustment parts **84-1** and **84-2** are easily formed by press working. Further, the extension parts **85-1** and **85-2** and the mounting terminal parts **86-1** and **86-2** are positioned with accuracy.

The ground contact members **90** and the first and second signal contact members **81-1** and **81-2** are press-fitted into the block body **60** from its Y_1 side to be incorporated therein.

Each ground contact member **90** is press-fitted into the corresponding slit **70** its ground contact part **92** first. FIG. **6**A is a cross-sectional view of the plug connector **50** of FIG. **2** taken along the line A—A. Referring to FIG. **6**A, the base part **91** is positioned inside the slit **70**. The ground contact part **92** is positioned inside the slit **73** beyond the slit **70**. A Z_1-side end face **92***b* and a Z_2-side end face **92***c* of the ground contact part **92** are exposed on the Z_1-side face and the Z_2-side face, respectively, of the projection part **64**. A cutout portion **92***a* at the end of the ground contact part **92** is fitted to the connection part **64***a*. The Y_1-side half portion **91***b* of the base part **91** including the Z_2-side projection portion **91***b***1** projects in the Y_1 direction from the main body part **61** of the block body **60**. The Z_2-side projection portion **91***b***1** and the mounting terminal part **93** are fitted in the slit **76** so that the position of the mounting terminal part **93** is controlled along the X-axis.

Each first signal contact member **81-1** is press-fitted into the corresponding tunnel **71** its signal contact part **83-1** first. FIG. **6**B is a cross-sectional view of the plug connector **50** of FIG. **2** taken along the line B—B. Referring to FIG. **6**B, the base part **82-1** is positioned inside the tunnel **71**. The signal contact part **83-1** is positioned inside the groove **74** beyond the tunnel **71** to be exposed on the Z_1-side face of the projection part **64**. The length adjustment part **84-1**, the extension part **85-1**, and the mounting terminal part **86-1** project in the Y_1 direction from the main body part **61** of the block body **60**. A portion of the extension part **85-1** close to the mounting terminal part **86-1** is fitted in the slit **77** so that the position of the mounting terminal part **86-1** is controlled along the X-axis.

Each second signal contact member **81-2** is press-fitted into the corresponding tunnel **72** its signal contact part **83-2** first. FIG. **6**C is a cross-sectional view of the plug connector **50** of FIG. **2** taken along the line C—C. Referring to FIG. **6**C, the base part **82-2** is positioned inside the tunnel **72**. The signal contact part **83-2** is positioned inside the groove **75** beyond the tunnel **72** to be exposed on the Z_1-side face of the projection part **64**. The length adjustment part **84-2**, the extension part **85-2**, and the mounting terminal part **86-2** project in the Y_1 direction from the main body part **61** of the block body **60**. A portion of the extension part **85-2** close to the mounting terminal part **86-2** is fitted in the slit **78** so that the position of the mounting terminal part **86-2** is controlled along the X-axis.

The ground contact parts **92** and the signal contact parts **83-1** and **83-2** are disposed at the same pitch P_1. The mounting terminal parts **93**, **86-1**, and **86-2** are disposed with accuracy at the same pitch P_2, which is two-thirds of the pitch P_1. The mounting terminal parts **93**, **86-1**, and **86-2** are aligned on the X-Y plane defining the bottom face of the block body **60**. Although the pitch P_2 for the mounting terminal parts **93**, **86-1**, and **86-2** is narrow, an accident such as a short circuit is prevented from occurring because the deflection of the mounting terminal parts **93**, **86-1**, and **86-2** in the X_1 and X_2 directions is controlled by the position control part **65**.

The first and second signal contact members **81-1** and **81-2** are provided between the ground contact members **90** adjacent thereto in the X_1 and X_2 directions, and the first and second signal contact members **81-1** and **81-2**, from the signal contact parts **83-1** and **83-2** to the mounting terminal parts **86-1** and **86-2**, fall within the projected area of each adjacent ground contact member **90**, for instance, the X_2-side ground contact member **90** in the case of projecting the X_2-side ground contact member **90** from the X_2 side. Accordingly, a first pair of the first and second signal contact members **81-1** and **81-2** and a second pair of the first and second signal contact members **81-1** and **81-2** are separated by a corresponding one of the ground contact members **90** so that their mutual interference is controlled. Particularly, the length adjustment parts **84-1** and **84-2** and the extension parts **85-1** and **85-2** of the first and second signal contact members **81-1** and **81-2** of the first pair and the length adjustment parts **84-1** and **84-2** and the extension parts **85-1** and **85-2** of the first and second signal contact members **81-1** and **81-2** of the second pair are separated by the Y_1-side half portion **91***b* of the base part **91** of the corresponding one of the ground contact members **90** so that their mutual interference is controlled.

Further, referring to FIGS. **6**B and **6**C, the height H_3 of each of the length adjustment parts **84-1** and **84-2** at its Y_1-side end is intermediate between the height H_1 of the signal contact part **83-1** and the height H_2 of the signal contact part **83-2**. Here, the word "height" refers to the distance from the X-Y plane defining the bottom face of the

block body **60** along the Z-axis. The length adjustment parts **84-1** and **84-2** adjust the length of the first contact member **81-1** and the length of the second signal contact member **81-2**, respectively, so that the length of the first signal contact member **81-1** from the end of the signal contact part **83-1** to the end of the mounting terminal part **86-1** is equal to the length of the second signal contact member **81-2** from the end of the signal contact part **83-2** to the end of the mounting terminal part **86-2**. Further, the extension parts **85-1** and **85-2** each extending in an inversed L-letter shape coincide with each other when viewed along the X-axis as shown in FIGS. **6**B and **6**C, and extend parallel to each other as shown in FIG. **4**. Accordingly, while paired "+" and "−" signals are transmitted inside the plug connector **50**, or through the extension parts **85-1** and **85-2**, the coupling of the "+" and "−" signals continues to be maintained so that no skew occurs.

Referring to FIG. **2**, the boss parts **66** of the block body **60** are fitted into holes **106** of a printed circuit board **105** so that the plug connector **50** is positioned thereon. Further, the mounting terminal parts **93**, **86-1**, and **86-2** are soldered to pads **107** aligned on the printed circuit board **105** so that the plug connector **50** is mounted thereon. A jack connector for differential transmission **110** may be connected to the mounted plug connector **50** with the projection part **64** of the plug connector **50** being fitted into a connection opening **111** of the jack connector **110** in which opening **111** terminals are arranged.

FIG. **7** is a diagram showing a variation of the signal contact pair **80** (that is, a signal contact pair **80**A). Referring to FIG. **7**, first and second signal contact members **81**A-1 and **81**A-2 forming the signal contact pair **80**A have respective length adjustment parts **84**A-1 and **84**A-2 extending from the center of a base part **82**A-1 and the center of a base part **82**A-2, respectively. The length adjustment part **84**A-1 is bent obliquely downward and in the X2 direction. The length adjustment part **84**A-2 is bent obliquely upward and in the X_1 direction. The width a_1 of each of the base parts **82**A-1 and **82**A-2 is smaller than the dimension a of each of the base parts **82-1** and **82-2** of FIG. **3**. The first signal contact member **81**A-1 has a signal contact part **83**A-1 projecting from the base part **82**A-1, an extension part **85**A-1 extending from the length adjustment part **84**A-1, and a mounting terminal part **86**A-1 extending from the extension part **85**A-1. The second signal contact member **81**A-2 has a signal contact part **83**A-2 projecting from the base part **82**A-2, an extension part **85**A-2 extending from the length adjustment part **84**A-2, and a mounting terminal part **86**A-2 extending from the extension part **85**A-2.

The present invention is not limited to the specifically disclosed embodiment, and variations and modifications may be made without departing from the scope of the present invention.

The present application is based on Japanese priority patent application No. 2003-148692, filed on May 27, 2003, the entire contents of which are hereby incorporated by reference.

What is claimed is:

1. A plug connector for differential transmission, comprising:

a block body made of an insulating material, the block body including a main body part and a projection part projecting therefrom;

a plurality of plate-like ground contact members each including a plate-like base part, a ground contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the ground contact part being fixed to the main body part and the projection part, respectively, of the block body;

a plurality of first signal contact members each including a base part, a signal contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the signal contact part being fixed to the main body part and the projection part, respectively, of the block body; and

a plurality of second signal contact members each including a base part, a signal contact part on a first side of the base part, and a mounting terminal part on a second side of the base part opposite to the first side, the base part and the signal contact part being fixed to the main body part and the projection part, respectively, of the block body,

wherein: the first signal contact members and the corresponding second signal contact members form signal contact pairs;

the signal contact pairs and the ground contact members are arranged alternately, being supported by the block body;

each ground contact member is shaped so that the ground contact member thereof is positioned vertically at a distance from a plane in which the mounting terminal part thereof is disposed, and a portion of the base part thereof on a mounting terminal part side and the mounting terminal part thereof each have a dimension smaller than that of the ground contact part thereof in a direction in which the ground contact members are arranged;

each of the first and second signal contact members is shaped so that a length adjustment part and an extension part are provided between the base part and the mounting terminal part thereof; and

the mounting terminal parts of the first and second signal contact members and the mounting terminal parts of the ground contact members are positioned in the same plane so that the mounting terminal parts of the first and second signal contact members of each signal contact pair are disposed between the mounting terminal parts of the ground contact members adjacent to the signal contact pair.

2. The plug connector as claimed in claim **1**, wherein the portion of the base part on the mounting terminal part side and the mounting terminal part of each ground contact member are formed by press working.

3. The plug connector as claimed in claim **1**, wherein the length adjustment parts and the extension parts of the first and second signal contact members of each signal contact pair are positioned between portions of the base parts of the ground contact members adjacent to the signal contact pair, the portions each projecting from the main body part of the block body in a direction opposite to a direction in which the projection part of the block body projects from the main body part thereof.

4. The plug connector as claimed in claim **1**, wherein: the length adjustment parts of the first signal contact members and the length adjustment parts of the second signal contact members are curved in opposite directions so that each length adjustment part is positioned, at an end thereof on an extension part side, at a distance from the plane in which the mounting terminal parts of the first and second signal members are disposed, the distance being intermediate

between a distance from the plane at which the signal contact part of each first signal contact member is positioned and a distance from the plane at which the signal contact part of each second signal contact member is positioned; and

the extension parts of the first signal contact members and the extension parts of the second signal contact members extend parallel to each other from ends thereof on a length adjustment part side to the mounting terminal parts thereof.

5. The plug connector as claimed in claim **4**, wherein: each first signal contact member has the length adjustment part thereof extending from a portion of the base part thereof, the portion being offset from a center of the base part in a first direction; and

each second signal contact member has the length adjustment part thereof extending from a portion of the base part thereof, the portion being offset from a center of the base part in a second direction, the second direction being opposite to the first direction along a direction in which the signal contact pairs and the ground contact members are arranged.

6. The plug connector as claimed in claim **4**, wherein each first signal contact member has the length adjustment part thereof extending from a center of the base part thereof so as to curve in a first direction; and

each second signal contact member has the length adjustment part thereof extending from a center of the base part thereof so as to curve in a second direction, the second direction being opposite to the first direction along a direction in which the signal contact pairs and the ground contact members are arranged.

7. The plug connector as claimed in claim **1**, wherein: the block body includes a position control part projecting therefrom in a direction opposite to a direction in which the projection part of the block body projects from the main body part thereof; and

the mounting terminal parts of the ground contact members and the first and second signal contact members engage the position control part of the block body so that positions of the mounting terminal parts are controlled.

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